

Cognitions in antisocial personality and their association with “dark” traits

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Abstract

Unlike those associated with depressive symptoms, little is known about cognitions associated with antisocial personality and with its related traits (“dark traits”). Using the Scrambled Sentences Task, an instrument from depression research, we investigated cognitions such as justifications (external blaming for one’s behavior) and harm to others (based on the notion that some of these individuals enjoy harming or humiliating others) that we hypothesized may be prevalent in antisocial personality. Confirming our hypothesis, these cognitions were associated with ratings in different antisocial personality scales and with antisocial and detachment scores in the Alternative Model of Personality Disorders of the DSM-5 (AMPD) in three non-clinical samples, but not with depressive symptoms or neuroticism. Cognitions including harm to others were differentially associated with high sadism. These findings characterize empirically cognitions classes that are shared by all individuals with antisocial tendencies, and that differ from those associated with depressiveness.

Introduction

Antisocial personality is characterized by maximization of one's own utility disregarding the consequences for others, or even by placing positive value on damage or harm to others (Moshagen, Hilbig, & Zettler 2018; Moshagen, Zettler & Hilbig, 2020). Individual degrees in the tendency to enact antisocial behaviour (and display low levels of social value orientation, Hilbig, Thielmann et al., 2022) constitute manifestations of dark personality (Jones, 2013; Moshagen et al., 2020).

A multitude of traits exist within the dark personality, but factor-analytic studies have identified a common core tendency, the Dark Factor of personality (D, Moshagen et al., 2020). With respect of D, traits described in the literature as part of the dark personality may be considered as flavoured manifestations of it (Moshagen et al., 2018). Four of them have been most prominently studied and are known as the dark tetrad (psychopathy, Machiavellianism, narcissism and sadism, Buckels Trapnell & Paulhus, 2014; Paulhus & Williams, 2002).

In contrast to knowledge about personality and behaviour, little is known about the cognitions about the self and the world that accompany this personality trait (Bhar, Beck, & Butler 2012). There is considerable evidence that antisocial personalities entertain justificatory cognitions that rationalize their behaviour (Hilbig, Moshagen, Thielmann & Zettler, 2022; Moshagen et al., 2020). This suggests that a personality construct such as D integrates personality traits with specific cognitions (Hilbig, Thielmann, Zettler & Moshagen, 2022), but no empirical approach to document these cognitions has been undertaken.

In the clinical literature, cognitions have been extensively investigated in the context of affective disorders, starting from depression (Beck, 1976; Kovacs & Beck, 1978). Negative cognitions in depression involve a negative view of oneself, the world and the future (negative

cognitive triad, Bebbington, 1985; Beck, 1976; Beck & Rush, 1979). Further research in this area led to the development of an empirical task to assess the individual tendency to activate negative cognitions, the Scrambled Sentences Task (SST, Wenzlaff & Bates, 1998). Each item of the SST (Watson et al., 1955; Wenzlaff & Bates, 1998) consists of a few words in random order that may be used to form a grammatically correct sentence. The words and the formed sentence give information on the tendency to activate specific cognitions. For example, with a set such as “is the bright future dismal”, the frequency with which the sentence “the future is dismal” rather than “the future is bright” is selected is higher in depressed individuals and in at-risk participants (such as previously ill individuals; Hedlund & Rude, 1995; Kovacs & Beck, 1978; Rude, Wenzlaff, Gibbs, Vane & Whitney, 2002; Wenzlaff & Bates, 1998). Healthy participants, in contrast, tend to activate positive cognitions (Hedlund & Rude, 1995; Viviani, Dommès, Bosch, Stingl & Beschoner, 2018; Viviani et al., 2010).

In the present work, we used the SST methodology to investigate the existence of specific cognitions associated with scores in dark personality scales, viewed as proxies of D. In this SST, negative alternative sentences represented antisocial schemas, and the positive alternatives represented prosocial schemas. For example, in the sentence *Tim wants others to be hurt/supported* the word *hurt* represents an antisocial schema and the word *supported* represents a prosocial schema. We tested the association between rates of antisocial cognitions, as elicited by this version of the SST, with scores in dark personality scales. Our approach, implemented in a series of three experiments, was to vary the modalities of sample recruitment and the instrument for the assessment of dark personality between our experiments to verify generalizability of previous results (‘external validation’, Ramspek, Jager, Dekker, Zoccali & van Diepen, 2021; Dirnagl, Bannach-Brown & McCann, 2022).

We also verified the discriminatory validity of the SST for antisocial cognitions relative to negative cognitions associated with depressive symptoms and neuroticism (Viviani, Dommes, et al., 2018; Viviani, Mahler, et al., 2018) using the “shattered assumptions” SST, which was shown in previous research to present strong associations with depressive symptoms and especially with neuroticism (Viviani, Mahler, et al., 2018) in the five-factor model of personality (FFM). In using the shattered assumptions SST, our intent was to adopt an instrument that was well suited to assessing depressive cognitions related to personality traits and that captured beliefs about an unsupportive environment to provide discriminatory validity.

This SST contained cognitions in two domains: justificatory cognitions (such as the belief that people think about themselves first, as documented by previous research, Hilbig, Moshagen, et al., 2022; Moshagen et al., 2018, 2020), and cognitions representing individuals that are physically harmed, exploited, or humiliated. This second set of cognitions is motivated by the low value of the welfare of others in this personality trait (Moshagen et al., 2018) as well as by the attraction that these situations exert on sadistic individuals (Buckels, Jones & Paulhus, 2013; Moshagen et al., 2018). Data from the SST for depressive symptoms suggest a role of motivational factors in the individual propensity to select optimistic cognitions (Kienhöfer et al., 2022; Viviani, Dommes et al., 2018; Viviani et al., 2010). We hypothesized that scores in sadism may be specifically associated with cognitions in the harm domain, as these individuals may be motivated by representations where others are physically harmed or humiliated.

We also investigated the propensity for antisocial cognitions assessed by the SST within the trait-domains model of the ‘Alternative Model of Personality Disorders criterion B’ (AMPD) of the DSM-5 (American Psychiatric Association, 2013), a dimensional approach to psychopathology. We hypothesized that antisocial cognitions would be associated with the

AMPD trait-domain antagonism (which represents antisocial traits included in D, Scholz, Hilbig, Thielmann, Moshagen & Zettler, 2022) and not with negative affectivity (which is closely related to FFM neuroticism, Al-Dajani, Gralnick & Bagby, 2016).

Three experiments were conducted. The first experiment had the primary aim to explore the plausibility of a specific association between recruitment of antisocial cognitions and scores in antisocial personality, as assessed by common rating scales (SD3 and ASP, Jones & Paulhus, 2014; Plouffe, Saklofske & Smith, 2017). To assess individual differences in behaviour, we administered the social value orientation scale (SVO, Murphy, Ackermann & Handgraaf, 2011) and let participants play a simulated dictator game, a formalized economic interaction that captures antisocial behavior (Moshagen et al., 2018). In the second experiment, we wanted to replicate the key association of antisocial cognitions with dark personality scores of the first experiment and further characterize individuals giving high antisocial SST scores in the AMPD dimensional system. In the third and final experiment we administered the antisocial cognitions SST and D, a scale recently developed to capture the full scope of dark personality (Moshagen et al., 2018, 2020), and the five ‘themes’ that characterize its variants (Bader et al., 2021) to a large community sample. In all experiments, we also analysed how cognitions related to harm to others and justifications for antisocial behaviour were associated with variants of the dark personality.

Results

Positive sentences (i.e., prosocial sentences/sentences without sadistic content in the SST for dark personality, and sentences with optimistic content in the SST for shattered assumptions) were modelled in a repeated measurements logistic regression with subjects and sentences as random factors. Hence in what follows, a negative coefficient indicates a lower rate of what we may call, for lack of a better term, “healthy” sentences. For example, a

negative coefficient of antisocial personality scores means that individuals with high scores were making more antisocial sentences. In all models, age and gender were confounding covariates.

First experiment

Participants in the first experiment ($N = 55$, average age 30.7, 19 females) were recruited online. Efforts were made to avoid recruitment among students (see Supplementary Methods for details on the sample). Correlations between the variables of the first experiment are shown in the Supplementary Material (Table S1).

Dark personality subscales were correlated with each other, as did the behavioural data. Only narcissism showed a significant correlation with the dictator game (more money kept for oneself, Murphy et al., 2011; Murphy & Ackermann, 2014; Seuntjens, Zeelenberg, van de Ven & Breugelmans, 2015; Fehr & Krajbich, 2014) and the SVO (less social value orientation, Murphy et al., 2011).

As in the depression (Wenzlaff & Bates, 1998) or shattered-assumption (Viviani, Mahler, et al., 2018) versions of the SST participants were preferentially forming positive sentences (antisocial sentences, $z = 7.23$, $p < .001$; shattered assumptions sentences, $z = 5.79$, $p < .001$). When adding age and sex to the model, we found no significant associations with antisocial sentences ($z = .40$ and $z = .61$).

We then proceeded to test one of the main hypotheses of this experiment, namely the association between scores in the antisocial sentences and the scores on the dark personality scales. To verify that this association was specific, we included in the same model the predictors dark personality (Jones & Paulhus, 2014; Plouffe et al., 2017) and neuroticism (Borkenau & Ostendorf, 1993) simultaneously, after adjusting also for age and gender. There was a significant association between rates of antisocial sentences and dark personality total

scores ($z = -6.07, p < .001$), while the association with neuroticism was not significant ($z = .16, p = .874$), as expected (Figure 0A and Table S2 in the Supplementary material).

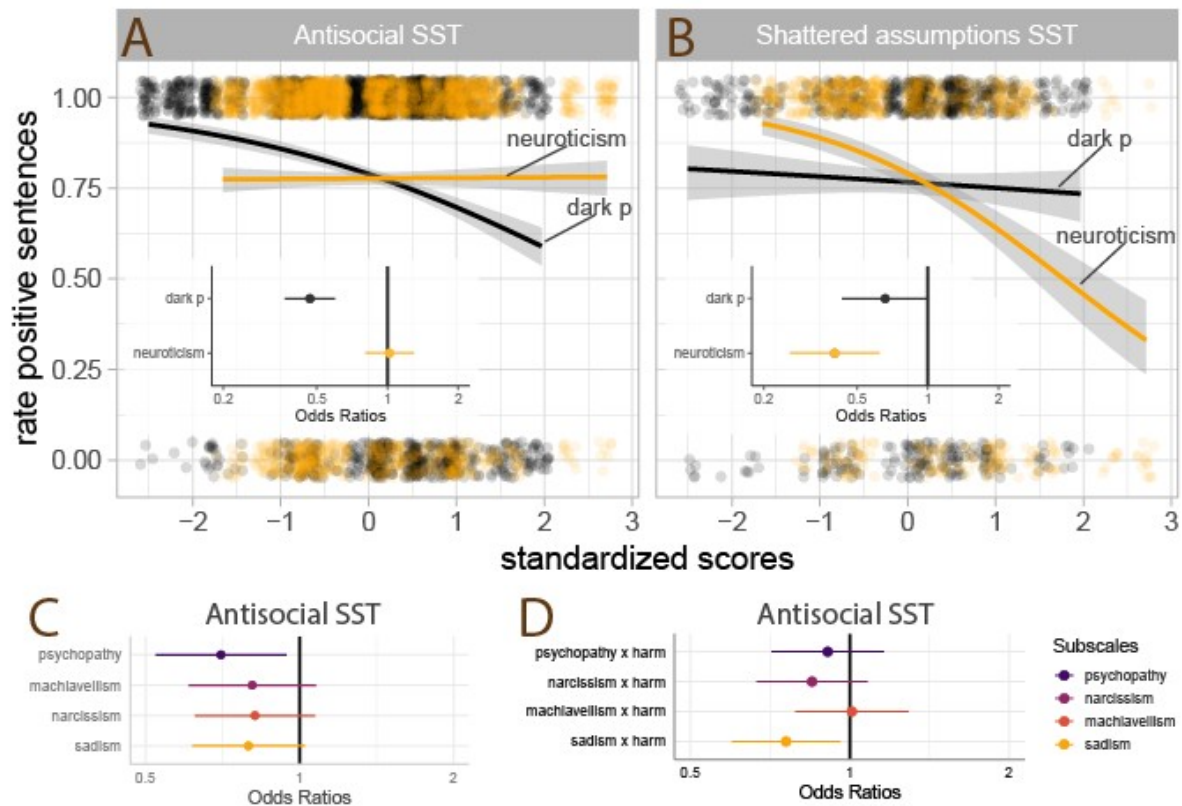


Figure 0. A, B: Prediction of sentence formation by dark personality and neuroticism scores in the antisocial and in the shattered assumptions SST. The black line represents the fitted rate of positive sentence formation (prosocial in panel A on the left, optimistic in panel B on the right) for individual differences in dark personality (standardized scores). The yellow line the fitted rate for individual differences in neuroticism (standardized scores). The individual points reproduce the density of positive or negative sentence formation for these two scales. In the insets, odds ratios for prosocial sentences for the standardized scores. C: Odds ratios for prosocial sentences in a model with all dark personality subscales were fitted simultaneously. One can see that they provide similar additional effects on sentence formation, after reciprocal adjustment. D: Odds ratios for prosocial sentences in models of the interaction of dark personality subscales and ‘harm’ content of sentences. The hypothesis was that this interaction would be significant in the interaction with sadism. All confidence intervals refer to 95% coverage probabilities.

According to this model, one standard deviation in dark personality scores resulted in an increase in the expected frequency of antisocial sentences from 14% (in individuals with average scores) to 25%. In contrast, the SST for shattered assumptions showed that the formation of a positive or negative sentence was primarily associated with neuroticism scores ($z = -4.08, p < .001$), while dark personality score gave an association only at trend level ($z =$

$-1.94, p = .052$; Figure 0B and Table S2). Here, one standard deviation in neuroticism scores resulted in an expected increase in pessimistic sentences from 14% (in individuals with average neuroticism) to 29%. These different association profiles could be confirmed by significant interactions: there were more negative sentences in the antisocial than in the shattered assumptions SST in individuals with high dark personality scores ($z = 2.66, p = .008$), while the opposite was the case in individuals with high neuroticism scores ($z = -7.07, p < .001$). In summary, scores in rating scales were primarily associated with negative sentences in the corresponding content type.

The dark personality scores summarize an overall trait that may be related to the common core tendency D identified in previous studies (Moshagen et al., 2018, 2020). However, the dark personality scales (Jones & Paulhus, 2014; Plouffe et al., 2017) also contain four subscales: psychopathy, narcissism, Machiavellianism, and sadism, whose scores were strongly associated in our data (Table S1 in Supplementary Material), consistently with the existence of a common core tendency. Hence, taken individually, they were all similarly associated with the rate of antisocial cognitions elicited by the SST. Also in a model where all these subscores were simultaneously included to estimate variance uniquely explained by each, they gave similar coefficients (Figure 0C).

The antisocial sentences belonged in two groups: justifications and harm sentences. There was no interaction between the effect of dark personality scores on the rate of antisocial sentences and these two types of sentences ($z = -1.42, p = .156$). However, this interaction was significant in the sadism subscale ($z = -2.30, p = .022$; Figure 0D). People with higher sadism scores selected more often the negative target (the word representing the antisocial schema in the SST for antisocial cognitions) in the harm sentences.

We then analysed the correlation between the SST and the results of the behavioural tasks (the association of dark personality scales with behaviour is reported in Table S1 in

Supplementary Material). In the SST for antisocial cognitions, there was an association with SVO scores ($t = 2.40, p = .017$). Individuals with higher SVO scores, indicating higher social-value orientation, formed more prosocial sentences. In the shattered assumptions SST, in contrast, the association with SVO scores was not significant ($t = 1.38, p = .360$). In the dictator game there was no association between the money allocated to oneself and rates of prosocial sentences (money kept for oneself and antisocial sentences, $t = .98, p = .330$).

In this experiment, participants were given no time limit to complete the sentences. Previous studies with the SST for depressive cognitions found no interaction between response times and individual differences in depressive symptoms (Kienhöfer et al., 2022). When modelling the effect of response time on sentence formation, we found no significant effect nor any significant interaction with personality traits (dark personality in antisocial sentences: $z = -.63, p = .528$; neuroticism in shattered assumptions sentences: $z = .86, p = .393$). Therefore, response time had no effect on the tendency to produce sentences that were associated with the respective scales in either SST.

Second experiment

The second experiment ($N = 98$, 65 females, mean age 23.8) had two aims. One was to replicate the association between antisocial sentences and dark personality scales of the first experiment, using a different scale to probe dark personality (SD4, Blötner, Ziegler, Wehner, Back & Grosz, 2022; Neumann, Jones & Paulhus, 2022). Personality was assessed in the AMPD (PID trait-dimensions, First, Skodol, Bender & Oldham, 2018; Kerber et al., 2022) expecting, as a generalized replication of the first experiment, to find an association with antisocial but not with negative affectivity trait-domains. We also assessed depressive symptoms with the CES-D scale (Hautzinger & Bailer, 1993). In contrast to the first experiments, participants were predominantly composed by students rewarded with study

credits. The second aim was to characterize individuals with high rates of antisocial cognitions, as elicited by the SST, in the dimensional characterization of personality of the AMPD across all personality domains. Correlations between the variables in the second experiment are shown in Table S3 in the Supplementary Material.

In the SST data, we found an overall tendency to form positive sentences ($z = 8.39, p < .001$) as in the first experiment. Females had a 9% higher probability of choosing the positive target (the word that represents the more prosocial schema in SST for antisocial cognitions) compared to males ($z = 3.15, p = .002$).

As in the first experiment, total SD4 scores were significant predictors of formation of antisocial sentences in the SST ($z = -2.39, p = .017$). In contrast, depressive symptoms levels ($z = -.94, p = .349$) or negative affectivity ($z = -.64, p = .521$) were not associated with sentence formation. These associations are illustrated in Figure 0A and Table S4 in the Supplementary Material.

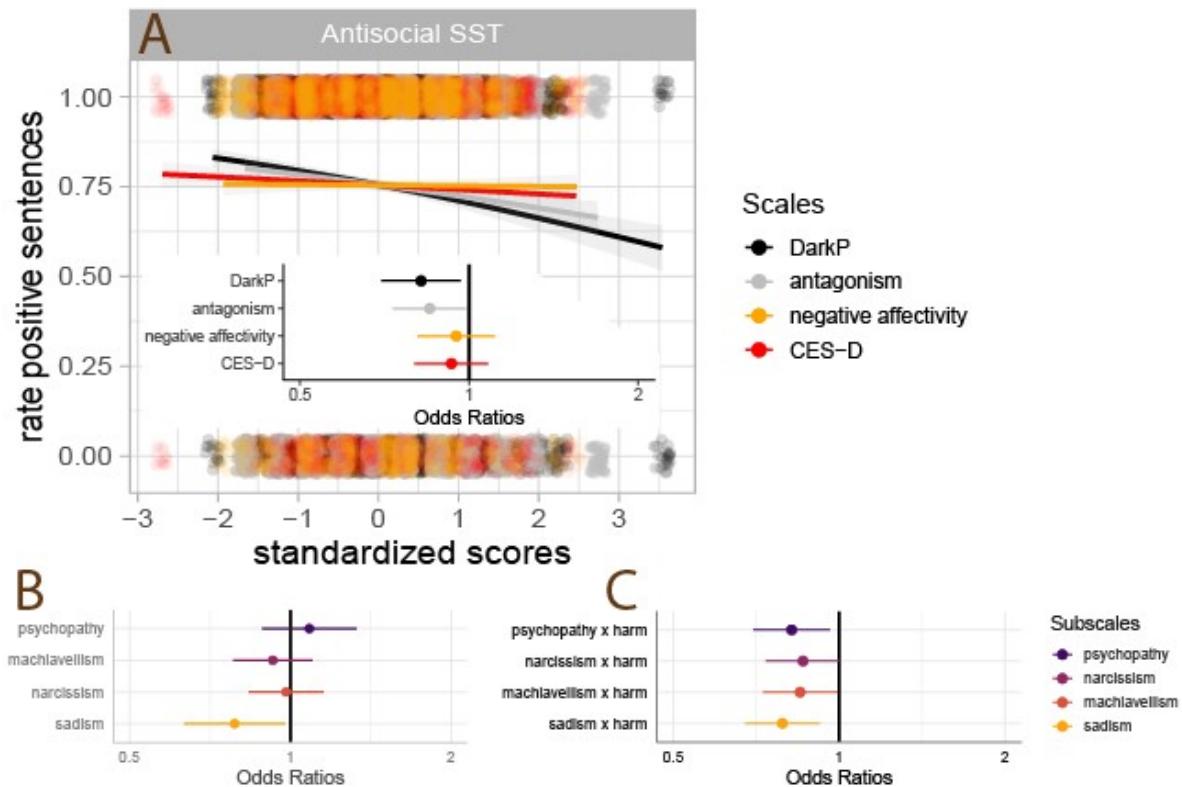


Figure 0 A: Logistic regression of prosocial sentence formation on dark personality and neuroticism scores. The fitted rate of positive sentence formation for individual differences in darkP (assessed with the SD4 scale) and antagonism (standardized scores) are shown by the black and the gray lines, respectively. The yellow and red lines show the fitted rates for individual differences in negative affectivity and depressive levels (CES-D, standardized scores). The individual points reproduce the density of positive or negative sentence formation for these two scales. In the insets, odds ratios for prosocial sentences for the standardized scores. B: odds ratios of prosocial sentence selection in model where all SD4 subscales were fitted simultaneously. One can see that in this dataset sadism is the only subscale that explains additional variance in the reduced selection of antisocial sentences. C: Odd ratios for prosocial sentences in models of the interaction of SD4 subscales and 'harm' content of sentences. In this dataset, harm sentences were more effective in eliciting an association with any subscale. The hypothesis was that this interaction would be significant in the interaction with sadism. All confidence intervals refer to 95% coverage probabilities.

Figure 0A shows that in this dataset there was one individual with very large standardized SD4 scores, and one with very low CES-D scores. Repeating the analysis without these individuals did not change the effect of SD4 ($z = -2.22$, $p = .027$) and slightly increased the effect of depressive levels ($z = -1.66$, $p = .097$).

Again, the SST sentences were divided into two subsets, those with justificatory and those representing harming others. As in the first experiment, the interaction between sadism and harm sentences could be replicated here ($z = -2.98$, $p = .003$; Figure 0C). Participants higher

in sadism more often chose the negative target in the harm subset of sentences than in the justifications set.

When characterizing individuals with high antisocial cognition SST scores in the dimensional space of the AMPD (PID trait-dimensions), we expected them to be associated with the trait-dimension of antagonism. Because the PID trait-dimensions tend to be positively associated with each other, and we were interested in the specific contribution of these trait-dimensions, we included all six of them in the model simultaneously. Antagonism was found to predict sentence formation as expected ($z = -2.05$, $p = .040$). However, also detachment scores were associated with a higher probability of choosing an antisocial sentences ($z = -3.76$, $p < .001$; Figure 0A; see also Table S5 in the Supplementary Material for the corresponding odds ratios). The effectiveness of detachment in predicting antisocial sentences was not changed by replacing antagonism with the SD4 total score in the model.

The effect of detachment remained substantially unaltered after adjusting for depression scores ($z = -3.68$, $p < .001$) while depressive symptom levels themselves showed no predictive effect ($z = .18$, $p = .856$).

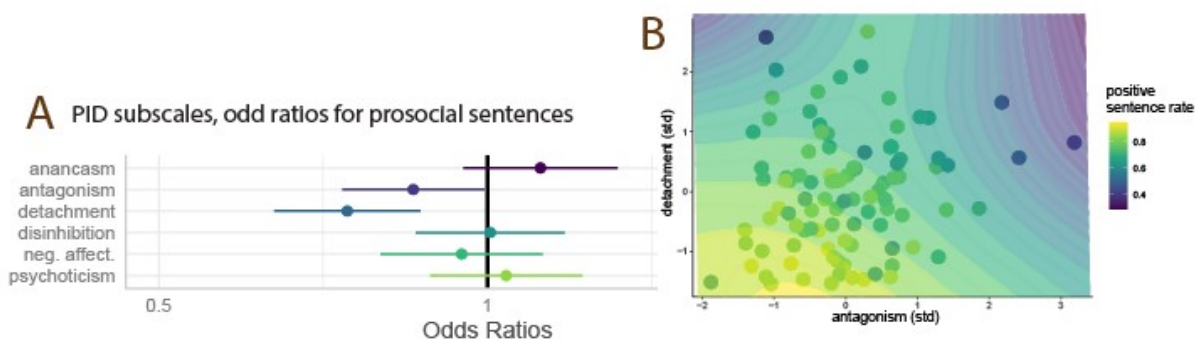


Figure 0. A: odds ratios for prosocial sentences in model with all PID subscales fitted simultaneously (95% confidence intervals). Only antagonism and detachment were associated with increased rates of antisocial sentences. B: color-coded heatmap of fitted ratio of prosocial sentences in the subspace spanned by antisocial personality (given by averaged SD4 and antagonism scores on the x axis) and detachment (on the y axis). The map is a smooth 2-dimensional estimate of the rate of prosocial sentences in individuals (shown by individual points in the map). The majority of individuals fell within two standardized scores of antisociality and detachment. Hence, heatmap estimates are most reliable within this range (the ridge at high levels of detachment is caused by one individual) and show a gradient of increasing antisocial sentences from yellow to green-blue.

To visualize the distribution of antisocial sentences in the subspace spanned by detachment and antisocial traits, we fitted splines to the positive sentence formation in a semiparametric logistic regression (Ruppert, Wand, & Carroll, 2003) adjusting for age and sex and estimating random effects for subjects and sentences as in the main model (see Methods for details). Antisocial tendencies were estimated by averaging the standardized SD4 and PID antagonism scores. The fitted probability to select a positive cognition in this subspace is displayed as a heatmap in Figure 0B (because extreme scores were scarce, an appropriate use of this heatmap should be limited to the area around the middle ground, where most individuals are located). The heatmap shows gradients of increasing antisocial sentence rates in either directions, high detachment or antisocial traits. The Figure also shows that in our sample there were no individuals with high antisocial and low detachment scores.

Third experiment

In the third experiment ($N = 960$, 549 females, mean age 39.52), the core disposition of dark personality was measured by the D scale (Moshagen et al., 2018, 2020). This experiment was conducted in a much larger community sample than the previous experiments (see Supplementary Methods from details). Besides providing a validation of the antisocial SST with a different instrument, we hoped to obtain evidence on different effects of sentence types (harm and justification) on personality facets and sex that may have suffered from the relatively low power of the previous experiments.

D displays an internal structure of five ‘themes’ (callousness, deceitfulness, narcissistic entitlement, sadism, and vindictiveness) which were derived from the D scale using factor analysis and represent specific characterizations of dark traits beyond the general factor D (Bader et al., 2021). Correlations between the variables of this experiment are shown in Table

S6 in the Supplementary Material. Overall, males and lower age showed a significant association with a higher score on D and the five factors/themes of D.

Also in this study, participants showed an overall tendency to choose the positive sentence ($z = 11.51, p < .001$). At average D scores, females were 3% more likely to choose the positive target than males ($z = -3.38, p < .001$), consistently with their lower D scores. Age was also a significant predictor of prosocial sentence selection ($z = 4.85, p < .001$), similarly again to the association of this variable with D scores. At average D scores, the probability of choosing the positive target increased from 84% to 86% when age increased by one standard deviation.

We then tested the key hypothesis of the current study, namely the association between target choice within the SST and D scores. As in previous experiments, a higher score in D was associated with a lower probability to choose the positive target ($z = -21.17, p < .001$). At average D scores, one standard deviation of higher D increased the probability of choosing an antisocial sentence from 16% to 25%. The fit of this model is shown in Figure 4A (continuous black line). The decreasing occurrence of sentence choices on the right of the figure (visible by the density of points representing positive and negative sentences) reflects the fact that, while most participants had a low to medium high D score, there were a few individuals with very high D scores (with a maximum of 4.66). This distribution likely reflects the fact that, in this much larger study, we had the chance to sample D levels that occur infrequently in the community and were not present in the previous experiments. Accordingly, at the high end of D scores range the fitted rate of prosocial sentences reached much lower levels here, as shown in the Figure. At this high end, there were individuals that choose prosocial sentences with a frequency of 30% or less, completely reversing the tendency to form prosocial sentences in the population (this reversal is what we observe also in high depressive symptom levels,

which are much more common than high D; see Kienhöfer et al., 2022, and the rates of negative shattered assumptions sentences in high neuroticism individuals of Figure 1B).

It should also be noted, however, that these few high-D participants raise the danger of single observations unduly affecting the fit. We therefore conducted a sensitivity analysis by log-transforming the D scores (to reduce the influence of the skew of the D scores) and excluding all participants with a log score of 1.1 or higher (corresponding to the exclusion of standardized scores of 3 or higher in the Figure). This analysis confirmed that a higher D score significantly decreased the probability to choose the positive target ($z = -14.82$, $p < .001$).

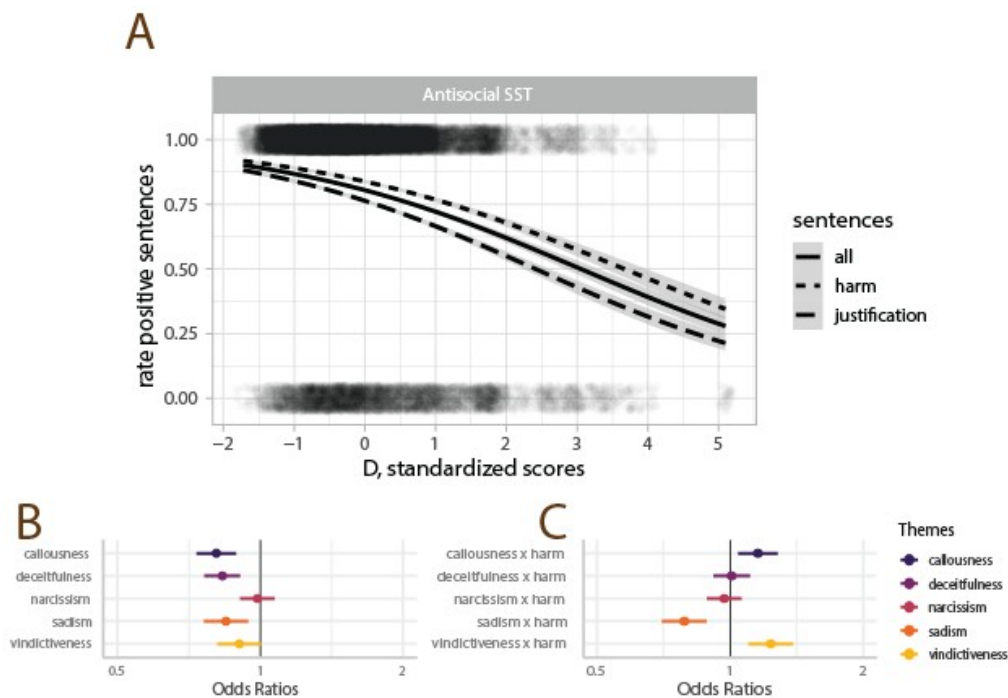


Figure 0. A: Logistic regression of sentence choice on D personality scores. The continuous line shows the fitted probability to select a prosocial sentence in all sentence types combined; the short and long dashed lines for the harm and justification sentence types separately. The individual points reproduce the density of prosocial or antisocial sentence selection. B: odds ratios of prosocial sentences in model where all D themes were fitted simultaneously. One can see that in this dataset most themes were explaining additional variance in sentence choice, suggesting specificity of content. C: Odd ratios for prosocial sentences in models of the interaction of D themes and ‘harm’ content of sentences. In this dataset, harm sentences were more effective in eliciting an association with the sadism theme. In addition, callousness and vindictiveness showed an interaction in the opposite direction, due to them being more effective in eliciting individual difference in prosocial sentence selection in the justification sentences. All confidence intervals refer to 95% coverage probabilities.

Both harm and justification sentences were effective in eliciting individual differences in D (effect of D in harm sentences: $z = -15.76$, $p < .001$; in justification sentences: $z = -20.64$, $p < .001$; Figure 4A, dashed black lines). However, justification sentences were more effective, with a significant interaction sentence type \times D ($z = 2.73$, $p = .006$). As we show below, the effectiveness of the justification sentences differed depending on the personality themes.

Figure 4B shows the effects on sentence selection of all five themes considered simultaneously in the same model. Callousness ($z = -4.36$, $p < .001$), deceitfulness ($z = -4.17$, $p < .001$) and sadism ($z = -3.04$, $p = .002$) remained significant predictors of the negative sentence selection after controlling for the other themes. The interaction with sentence type (harm or justification sentences), however, demonstrated the existence of differences among personality themes in eliciting of negative sentence selection depending on sentence types (Figure 4C). As in the previous experiments, the interaction with sadism was significantly negative ($z = -4.05$, $p < .001$), showing that individuals higher in sadism were also more likely to choose the negative target in harm sentences than in justification sentences. In contrast, the interactions between sentence type and callousness ($z = 2.77$, $p = .006$) as well as vindictiveness ($z = 3.55$, $p < .001$) showed that it was justification sentences that best predicted scores for these two themes. Hence, it appears that the inclusion of the callousness and vindictiveness themes was responsible for the increased effectiveness of justification sentences in eliciting individual differences with D as a whole.

Discussion

Numerous studies have shown that the SST may be used to provide evidence on the depressive disposition of individuals and their cognition patterns (for review, see Würtz et al., 2022). The aim of the present work was to use the SST to demonstrate the existence of a pattern of cognitions associated with high dark personality scores. In a clinical context, cognitions have been investigated with rating scales such as personality beliefs questionnaire

(PBQ, Beck, Butler, Brown, Dahlsgaard, Newman & Beck, 2001). However, there have been few studies on antisocial personality with this instrument (Bhar et al., 2012; McMurran & Christopher, 2008; Thimm, Jordan & Bach, 2016).

We could show that the rate of negative sentences elicited by this SST version was associated in a non-clinical sample with ratings of antisocial or psychopathic personality (or inversely associated with social value orientation scores) using a variety of instruments. Furthermore, there were little or no associations between these rates and measures of depressive levels, neuroticism, or negative affectivity, which are reliably associated to the SST for depressive disposition (Kienhöfer et al., 2022; Viviani, Mahler, et al., 2018).

From a theoretical perspective, it has been argued that the SST detects individual tendencies to activate cognitive schemas (Kienhöfer et al., 2022; Viviani, Mahler, et al., 2018), an assumption that also motivated the development of the SST for depressive schemata (Wenzlaff & Bates, 1998). This aspect of the SST is consistent with cognitive models developed in the context of the psychotherapy of depression (Beck, 1976; Kovacs & Beck, 1978).

When investigated within the framework of a dimensional classification such as the AMPD, individuals producing a high rate of antisocial cognitions were located in the subspace defined by the trait-domains antagonism and detachment. In contrast, individuals who produce a high rate of negative sentences in the SST for depression have high scores in negative affectivity and detachment (Kienhöfer et al., 2022). The involvement of detachment in our high-scoring individuals could not be explained by residual depressiveness, as it remained virtually unchanged after adjusting for current depressive symptoms levels and negative affectivity. Notwithstanding the involvement of detachment in both, these two subspaces of the personality spectrum are distinct. One possibility is that the cognitions that have been described in individuals with high dark personality scores may be viewed as

justifications for antisocial behavior but may also imply a view of social interactions as unsupportive or frankly hostile.

Our findings suggest that schemas associated with high levels of detachment are worth exploring further in a clinical context.

The nature of the processes active in the SST and responsible for eliciting these patterns of cognitions is still being debated (see for example Kienhöfer et al., 2022). The finding that these patterns are the same irrespective of response times suggest that their selection in the SST is deliberate rather than automatic. Further characterization of these processes may be given by neuroimaging studies of the SST, which have been very consistent in associating these processes with the neural substrates of preference-based choice (Viviani, Dommes, et al., 2018; Viviani et al., 2010). Preference-based choice is deliberate but consistent, and it has been shown to be based on sophisticated mechanisms of elaboration of information on the available options (Krajbich & Rangel, 2011; Labek et al. 2022; O'Doherty, 2011; Rangel & Hare, 2010; Viviani, Dommes, Bosch & Labek, 2020) and on subjective motivational factors (Bray, Rangel, Shimojo, Balleine & O'Doherty, 2008). Mechanisms with the same properties may also be active in schema selection, explaining both the selection of cognitions that are conformant to schemas as well as motivational influences. According to this model of schema selection, negative views of social interactions may be associated with schematic tendencies present in different groups of individuals, but personalities traits related to sadism may form a specific core based on a distinct motivational mechanism.

Materials and Methods

All data collection took place online through web interfaces. Participant were given information about the study in introductory web-pages, had to provide an age of 18 or older, and gave explicit informed consent before being admitted to the study. The consent form

specified the right of participants to withdraw from the experiment at any time; no data were retained for these participants. For more information on the sample and study design, the rating scales and the behavioural task, see the Supplementary Materials and Methods.

SST for antisocial cognitions

To assess antisocial cognitions, new items were developed following the pattern of the SST for depressive schemas (Wenzlaff & Bates, 1998). The creation of the items was based on existing scales (Jones & Paulhus, 2014; Plouffe et al., 2017) and the existing literature on characteristics and common features of the individual dark personality traits (Furnham, Richards & Paulhus, 2013; Jones & Figueredo, 2013; Moshagen et al., 2020). A total of 44 sentences could be derived. These sentences were divided into two categories based on D (Moshagen et al., 2020): *Harm* and *Justifications*. The former encompasses one's own maximization of utility and the potential or intended harm towards others while doing so (example: *little Tim gets a spanking/praise*). The second category, on the other hand, includes the accompanying justifications for utility maximization at the expense of others (example: *harming others is unavoidable/prohibited*). Each target (for detailed explanations see below) in the SST for antisocial cognitions was matched for length and frequency in the German language (Institut für Deutsche Sprache, 2013) and refers to a specific word in the sentence (the anchor, Viviani, Dommes et al., 2018). To prevent comprehension difficulties in the implementation of the SST, exercise tasks were carried out before the actual start of the task.

In experiment 2, the same antisocial cognitions SST was used, except that a time limit of 7.5 seconds for each SST sentence was set. If the participant didn't give a response within this limited time, the response was coded as missing.

The task was originally administered verbally and in paper-pencil format (Hedlund & Rude, 1995; Watson et al., 1955; Wenzlaff & Bates, 1998) and later converted to a computerized form (Viviani, Dommes, et al., 2018), which was also the form adopted in the

present experiment. In each item, it is possible to form two sentences that differ only by the last word of the sentence (the target, Viviani, Dommes, et al., 2018). Thus, only five words are needed per correct sentence, one of which is the target. The two possible targets per item conventionally represent a positive/optimistic schema and a negative/pessimistic schema (Viviani, Dommes, et al., 2018; Wenzlaff & Bates, 1998).

SST for shattered assumptions

To test the divergent validity of the newly developed SST for antisocial cognitions and whether the SST can be conducted online, the already validated SST for shattered assumptions (Mahler, 2015; Viviani, Mahler, et al., 2018) was used. The concept of “shattered assumptions” emerged in the research on cognitions in post-traumatic conditions (Janoff-Bulman, 1989) and refers to the post-traumatic emergence of negative cognitions representing the world as unreliable and unsupportive, in lieu of the generically pessimistic cognitions of depression. It is important to underscore, however, that past studies suggest that these cognitions, as assessed by the SST, as well the scores of rating scales for shattered assumptions, are associated to the intensity of depressive symptoms in clinically non-depressive individuals (Viviani, Mahler, et al., 2018). Hence, the shattered assumptions SST may also be considered an assessment of depressive cognitions. We selected the 14 sentences that had worked best in previous studies (Mahler, 2015; Viviani, Mahler, et al., 2018) and conducted them online to check if previously found results of the SST can be replicated (example: *I feel alive/dead inside*; Mahler, 2015; Viviani, Mahler, et al., 2018).

Statistical analysis

Statistical analyses were conducted with RStudio (R version 4.2.0). Mixed-effects logistic regression was used (*lme4* package, version 1.1-29), controlling for age and sex and modelling subjects and the SST sentences as random effects to account for repeated

measurements. This package has stringent checks for convergence of the procedure used to compute the fit, which were passed by all models in the study. Formation of a positive sentence (prosocial or optimistic in the shattered assumptions SST) was coded as ‘success’. A negative coefficient in this context therefore means that the higher the predictor, the lower the probability of forming the positive sentence. Any selected word found to be neither a positive nor negative target word was coded as an error and not included in the analysis.

Plots were created with the package *ggplot2*, version 3.3.6 (Wickham, 2016). The plot of Figure 3 was created prior to fitting a semiparametric model to the SST data of Experiment 2 with the function *brm* of the *brms* package (Bürkner, 2017). Formation of a positive sentence was modelled in a mixed-effects logistic regression with subjects and SST sentences as random effects, thin-plate splines to model the surface with coordinates detachment and the mean values of PID antagonism and SD4 (after standardization), and sex as confounding covariate. The package *brm* implements a Bayesian approach, which is here to model the coefficients of the splines as a random effect, estimating the degree of smoothing from the data through the estimated variance parameter of these coefficients (Ruppert et al., 2003). The fitted 2-D surface of estimated rates of formation of positive sentences was visualized with the *conditional_smooths* function of the same package and refined with *ggplot2* for labels.

In Experiment 1, trials were excluded if participants stated that they did not answer the questions honestly (one participant) or if they stated that they did not conduct the SST correctly (two participants). In Experiment 2, trials were excluded where participants did not finish the survey (37 participants) and participants who did not select the correct target (a word that at the end of the sentence gave a grammatically correct construct) or failed to respond within the 7.5 sec time limit more than twelve times (11 participants). In Experiment 3 we were able to recruit 1453 participants. Participants were excluded who took less than 2

seconds on average to complete the SST (24 participants) if they made more than 12 error or misses (469), resulting in a total sample of 960 participants.

References

- Al-Dajani, N., Gralnick, T. M., & Bagby, R. M. (2016). A Psychometric Review of the Personality Inventory for DSM–5 (PID–5): Current Status and Future Directions. *Journal of Personality Assessment*, 98(1), 62–81. <https://doi.org/10.1080/00223891.2015.1107572>
- American Psychiatric Association (Hrsg.). (2013). *Diagnostic and statistical manual of mental disorders: DSM-5* (5th ed). Arlington, VA,: American Psychiatric Association.
- Bader, M., Hartung, J., Hilbig, B. E., Zettler, I., Moshagen, M., & Wilhelm, O. (2021). Themes of the dark core of personality. *Psychological Assessment*, 33(6), 511–525. <https://doi.org/10.1037/pas0001006>
- Bebbington, P. (1985). Three cognitive theories of depression. *Psychological Medicine*, 15(4), 759–769. <https://doi.org/10.1017/S0033291700004992>
- Beck, A. T. (1976). *Cognitive therapy and the emotional disorders*. Oxford: International Universities Press.
- Beck, A. T., Butler, A. C., Brown, G. K., Dahlsgaard, K. K., Newman, C. F., & Beck, J. S. (2001). Dysfunctional beliefs discriminate personality disorders. *Behaviour Research and Therapy*, 39(10), 1213–1225. [https://doi.org/10.1016/S0005-7967\(00\)00099-1](https://doi.org/10.1016/S0005-7967(00)00099-1)
- Beck, A. T., & Rush, A. J. (Hrsg.). (1979). *Cognitive therapy of depression* (13. print). New York: Guilford Press.
- Bhar, S. S., Beck, A. T., & Butler, A. C. (2012). Beliefs and personality disorders: An overview of the personality beliefs questionnaire. *Journal of Clinical Psychology*, 68(1), 88–100. <https://doi.org/10.1002/jclp.20856>

- Blötner, C., Ziegler, M., Wehner, C., Back, M. D., & Grosz, M. P. (2022). The Nomological Network of the Short Dark Tetrad Scale (SD4). *European Journal of Psychological Assessment*, 38(3), 187–197. <https://doi.org/10.1027/1015-5759/a000655>
- Borkenau, P. & Ostendorf, F. (1993). *NEO-Fünf-Faktoren Inventar (NEO-FFI) nach Costa und McCrae*. Göttingen: Hogrefe.
- Buckels, E. E., Jones, D. N., & Paulhus, D. L. (2013). Behavioral Confirmation of Everyday Sadism. *Psychological Science*, 24(11), 2201–2209. <https://doi.org/10.1177/0956797613490749>
- Buckels, E. E., Trapnell, P. D., & Paulhus, D. L. (2014). Trolls just want to have fun. *Personality and Individual Differences*, 67, 97–102. <https://doi.org/10.1016/j.paid.2014.01.016>
- Bürkner, P.-C. (2017). brms: An R Package for Bayesian Multilevel Models Using Stan. *Journal of Statistical Software*, 80(1). <https://doi.org/10.18637/jss.v080.i01>
- Bray, S., Rangel, A., Shimojo, S., Balleine, B., & O'Doherty, J. P. (2008). The Neural Mechanisms Underlying the Influence of Pavlovian Cues on Human Decision Making. *The Journal of Neuroscience*, 28(22), 5861-5866. <https://doi.org/10.1523/JNEUROSCI.0897-08.2008>
- Dirnagl, U., Bannach-Brown, A., & McCann, S. (2022). External validity in translational biomedicine: Understanding the conditions enabling the cause to have an effect. *EMBO Molecular Medicine*, 14(2), e14334. <https://doi.org/10.15252/emmm.202114334>
- Fehr, E., & Krajbich, I. (2014). Social Preferences and the Brain. In P.W. Glimcher & E. Fehr (Eds.), *Neuroeconomics: Decision Making and the Brain* (2nd ed., pp. 193-218). London, Waltham, San Diego: Elsevier Academic Press.
- First, M. B., Skodol, A. E., Bender, D. S., & Oldham, J. M. (2018). User's guide for the SCID-5-AMPD: Structured clinical interview for the DSM-5 alternative model for personality disorders. Washington, DC: American Psychiatric Association Publishing.

- Furnham, A., Richards, S. C., & Paulhus, D. L. (2013). The Dark Triad of Personality: A 10 Year Review: Dark Triad of Personality. *Social and Personality Psychology Compass*, 7(3), 199–216. <https://doi.org/10.1111/spc3.12018>
- Hautzinger, M., & Bailer, M. (1993). *Allgemeine Depressionsskala (ADS)*. Weinheim: Beltz Test GmbH.
- Hedlund, S., & Rude, S. S. (1995). Evidence of latent depressive schemas in formerly depressed individuals. *Journal of Abnormal Psychology*, 104(3), 517–525. <https://doi.org/10.1037/0021-843X.104.3.517>
- Hilbig, B. E., Moshagen, M., Thielmann, I., & Zettler, I. (2022). Making rights from wrongs: The crucial role of beliefs and justifications for the expression of aversive personality. *Journal of Experimental Psychology: General*, 151(11), 2730–2755. <https://doi.org/10.1037/xge0001232>
- Hilbig, B. E., Thielmann, I., Zettler, I., & Moshagen, M. (2022). The Dispositional Essence of Proactive Social Preferences: The Dark Core of Personality vis-à-vis 58 Traits. *Psychological Science*, 34(2), 201–220.. <https://doi.org/10.1177/09567976221116893>
- Institut für Deutsche Sprache (2013). *Korpusbasierte Wortgrundformenliste DeReWo, v-ww-bll-320000g-2012-12-31-1.0, mit Benutzerdokumentation*. Institut für Deutsche Sprache, Programmbereich Korpuslinguistik, Mannheim. Retrieved September 5, 2019, from <http://www.ids-mannheim.de/derewo>.
- Janoff-Bulman, R. (1989). Assumptive Worlds and the Stress of Traumatic Events: Applications of the Schema Construct. *Social Cognition*, 7(2), 113–136. <https://doi.org/10.1521/soco.1989.7.2.113>
- Jones, D. N. (2013). What's mine is mine and what's yours is mine: The Dark Triad and gambling with your neighbor's money. *Journal of Research in Personality*, 47(5), 563–571. <https://doi.org/10.1016/j.jrp.2013.04.005>

- Jones, D. N., & Figueredo, A. J. (2013). The Core of Darkness: Uncovering the Heart of the Dark Triad. *European Journal of Personality*, 27(6), 521–531. <https://doi.org/10.1002/per.1893>
- Jones, D. N., & Paulhus, D. L. (2014). Introducing the Short Dark Triad (SD3): A Brief Measure of Dark Personality Traits. *Assessment*, 21(1), 28–41. <https://doi.org/10.1177/1073191113514105>
- Kerber, A., Schultze, M., Müller, S., Rühling, R. M., Wright, A. G. C., Spitzer, C., Krueger, R. F., Knaevelsrud, C., & Zimmermann, J. (2022). Development of a Short and ICD-11 Compatible Measure for *DSM-5* Maladaptive Personality Traits Using Ant Colony Optimization Algorithms. *Assessment*, 29(3), 467–487. <https://doi.org/10.1177/1073191120971848>
- Kienhöfer, V., Mirgel, S., Wilhelm, S., Fischle, S., Rabl, L., Labek, K., & Viviani, R. (2022). *Negative Cognitions in the Personality Domains of the AMPD* [Preprint]. PsyArXiv. <https://doi.org/10.31234/osf.io/v7nh6>
- Kovacs, M., & Beck, A. T. (1978). Maladaptive cognitive structures in depression. *American Journal of Psychiatry*, 135(5), 525–533. <https://doi.org/10.1176/ajp.135.5.525>
- Krajovich, I., & Rangel, A. (2011). Multialternative drift-diffusion model predicts the relationship between visual fixations and choice in value-based decisions. *Proceedings of the National Academy of Sciences of the United States of America*, 108(33), 13852–13857. <https://doi.org/10.1073/pnas.1101328108>
- Labek, K., Sittenberger, E., Kienhöfer, V., Rabl, L., Messina, I., Schurz, M., Stingl, J. C., & Viviani, R. (2022). The gradient model of brain organization in decisions involving "empathy for pain". *Cerebral Cortex*, bhac464. <https://doi.org/10.1093/cercor/bhac464>
- Mahler, J. (2015). *Validierung der elektronischen Form des Scrambled Sentences Tests für traumaspezifische Kognitionen* (unpublished masterthesis). Leopold-Franzens-Universität Innsbruck.

- McMurran, M., & Christopher, G. (2008). Dysfunctional beliefs and antisocial personality disorder. *Journal of Forensic Psychiatry & Psychology*, 19(4), 533–542. <https://doi.org/10.1080/14789940801947800>
- Moshagen, M., Hilbig, B. E., & Zettler, I. (2018). The dark core of personality. *Psychological Review*, 125(5), 656–688. <https://doi.org/10.1037/rev0000111>
- Moshagen, M., Zettler, I., & Hilbig, B. E. (2020). Measuring the dark core of personality. *Psychological Assessment*, 32(2), 182–196. <https://doi.org/10.1037/pas0000778>
- Murphy, R. O., & Ackermann, K. A. (2014). Social Value Orientation: Theoretical and Measurement Issues in the Study of Social Preferences. *Personality and Social Psychology Review*, 18(1), 13–41. <https://doi.org/10.1177/1088868313501745>
- Murphy, R. O., Ackermann, K. A., & Handgraaf, M. (2011). Measuring Social Value Orientation. *Judgment and Decision Making*, 6(8), 771–781. <https://doi.org/10.2139/ssrn.1804189>
- Neumann, C. S., Jones, D. N., & Paulhus, D. L. (2022). Examining the Short Dark Tetrad (SD4) Across Models, Correlates, and Gender. *Assessment*, 29(4), 651–667. <https://doi.org/10.1177/1073191120986624>
- O'Doherty, J. P. (2011). Contributions of the ventromedial prefrontal cortex to goal-directed action selection. *Annals of the New York Academy of Sciences*, 1239, 118–129. <https://doi.org/10.1111/j.1749-6632.2011.06290.x>
- Paulhus, D. L., & Williams, K. M. (2002). The Dark Triad of personality: Narcissism, Machiavellianism, and psychopathy. *Journal of Research in Personality*, 36(6), 556–563. [https://doi.org/10.1016/S0092-6566\(02\)00505-6](https://doi.org/10.1016/S0092-6566(02)00505-6)

- Plouffe, R. A., Saklofske, D. H., & Smith, M. M. (2017). The Assessment of Sadistic Personality: Preliminary psychometric evidence for a new measure. *Personality and Individual Differences, 104*, 166–171. <https://doi.org/10.1016/j.paid.2016.07.043>
- Ramspek, C. L., Jager, K. J., Dekker, F. W., Zoccali, C., & van Diepen, M. (2021). External validation of prognostic models: What, why, how, when and where? *Clinical Kidney Journal, 14*(1), 49–58. <https://doi.org/10.1093/ckj/sfaa188>
- Rangel, A., & Hare, T. (2010). Neural computations associated with goal-directed choice. *Current opinion in neurobiology, 20*(2), 262–270. <https://doi.org/10.1016/j.conb.2010.03.001>
- Reips, U.-D. (2002). Standards for Internet-Based Experimenting. *Experimental Psychology, 49*(4), 243–256. <https://doi.org/10.1026//1618-3169.49.4.243>
- Rude, S. S., Wenzlaff, R. M., Gibbs, B., Vane, J., & Whitney, T. (2002). Negative processing biases predict subsequent depressive symptoms. *Cognition & Emotion, 16*(3), 423–440. <https://doi.org/10.1080/02699930143000554>
- Ruppert, D., Wand, M. P., & Carroll, R. J. (2003). *Semiparametric Regression* (1. Aufl.). Cambridge: Cambridge University Press. <https://doi.org/10.1017/CBO9780511755453>
- Scholz, D. D., Hilbig, B. E., Thielmann, I., Moshagen, M., & Zettler, I. (2022). Beyond (low) Agreeableness: Toward a more comprehensive understanding of antagonistic psychopathology. *Journal of Personality, 90*(6), 956–970. <https://doi.org/10.1111/jopy.12708>
- Seuntjens, T. G., Zeelenberg, M., van de Ven, N., & Breugelmans, S. M. (2015). Dispositional greed. *Journal of Personality and Social Psychology, 108*(6), 917–933. <https://doi.org/10.1037/pspp0000031>
- Thimm, J. C., Jordan, S., & Bach, B. (2016). The Personality Inventory for DSM-5 Short Form (PID-5-SF): Psychometric properties and association with big five traits and pathological beliefs in

a Norwegian population. *BMC Psychology*, 4(1), 61. <https://doi.org/10.1186/s40359-016-0169-5>

Viviani, R., Dommes, L., Bosch, J. E., & Labek, K. (2020). Segregation, connectivity, and gradients of deactivation in neural correlates of evidence in social decision making. *NeuroImage*, 223, 117339. <https://doi.org/10.1016/j.neuroimage.2020.117339>

Viviani, R., Dommes, L., Bosch, J. E., Stingl, J. C., & Beschoner, P. (2018). A Computerized Version of the Scrambled Sentences Test. *Frontiers in Psychology*, 8, 2310. <https://doi.org/10.3389/fpsyg.2017.02310>

Viviani, R., Lo, H., Sim, E.-J., Beschoner, P., Stingl, J. C., & Horn, A. B. (2010). The Neural Substrate of Positive Bias in Spontaneous Emotional Processing. *PLoS ONE*, 5(11), e15454. <https://doi.org/10.1371/journal.pone.0015454>

Viviani, R., Mahler, J. S., Bosch, J. E., Dommes, L., Eberhardt, J., Beschoner, P., & Sasic-Vasic, Z. (2018). Adaptation of the Scrambled-Sentences Task to Assess “Shattered Assumptions:” Construction of the Test and Investigation of Neural Substrates in an fMRI Study. *Psychopathology*, 51(5), 306–317. <https://doi.org/10.1159/000491701>

Watson, R. E., Pritzker, L., & Madison, P. (1955). Hostility in neurotics and normals. *The Journal of Abnormal and Social Psychology*, 50(1), 36–40. <https://doi.org/10.1037/h0041326>

Wenzlaff, R. M., & Bates, D. E. (1998). Unmasking a cognitive vulnerability to depression: How lapses in mental control reveal depressive thinking. *Journal of Personality and Social Psychology*, 75(6), 1559–1571. <https://doi.org/10.1037/0022-3514.75.6.1559>

Wickham, H. (2016). *ggplot2: Elegant Graphics for Data Analysis* (2nd ed. 2016). Basel: Springer International Publishing. <https://doi.org/10.1007/978-3-319-24277-4>

Würtz, F., Zahler, L., Blackwell, S. E., Margraf, J., Bagheri, M., & Woud, M. L. (2022). Scrambled but valid? The scrambled sentences task as a measure of interpretation biases in psychopathology: A systematic review and meta-analysis. *Clinical Psychology Review*, 93, 102133. <https://doi.org/10.1016/j.cpr.2022.102133>

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Conceptualization: L. Rabl, R. Viviani, M. Moshagen; Methodology: L. Rabl, R. Viviani, M. Moshagen, V. Kienhöfer; Software: L. Rabl, R. Viviani, M. Moshagen; Formal Analysis: L. Rabl, R. Viviani, K. Labek; Investigation: L. Rabl, R. Viviani, M. Moshagen; Resources: L. Rabl, R. Viviani, K. Labek, M. Moshagen; Data Curation: L. Rabl, R. Viviani, M. Moshagen; Validation: L. Rabl, R. Viviani, K. Labek, M. Moshagen; Writing – Original Draft Preparation: L. Rabl, R. Viviani, K. Labek; Writing – Review & Editing: L. Rabl, R. Viviani, K. Labek, M. Moshagen, V. Kienhöfer; Visualization: L. Rabl, R. Viviani; Supervision: R. Viviani, K. Labek, M. Moshagen; Project Administration: L. Rabl, R. Viviani; Funding Acquisition: R. Viviani

Data and software availability statement

The datasets generated and/or analysed during the current study are available on request from the corresponding author (luna.rabl@uibk.ac.at) after verifying that further analyses are compatible with the aims stated in the consent form signed by participants. The SST software used is also available from the corresponding author (luna.rabl@uibk.ac.at). The German items of the SST for antisocial cognitions can be downloaded from OSF (DOI <https://doi.org/10.17605/OSF.IO/YFDQ4>).

Additional Information

We report in this article how we obtained our sample size and all reasons for excluding data, all statistical methods and software used. The experiments were conducted following guidelines for online experiments (Reips, 2002).

Preregistration

The sample and study design were registered before data collection. The registration of experiment 2 was made public (DOI <https://doi.org/10.17605/OSF.IO/YFDQ4>), the registration of experiment 1 remained private and is available from the corresponding author.

Reporting

We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study.

Ethical approval

All studies were approved by the Ethical Review Board of the Institute of Psychology of the University of Innsbruck.

Competing interests statement

The authors declare that there were no conflicts of interest with respect to the authorship or the publication of this article.

Supplemental Material

Supplemental Material is available online

Preprint

This manuscript has been loaded onto a preprint server (<https://psyarxiv.com/gz7hp/>)